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OMSAPC Advisory Circular

Subject: Criteria for Determining the Acceptability of Mileage Accumulation on an Outdoor Chassis Dynamometer

I. Purpose

The purpose of this advisory circular (A/C) is to update the general criteria to be used to determine if the mileage accumulated on a chassis dynamometer is sufficiently similar to the mileage accumulated on a road route. This A/C supersedes A/C No. 35A.

II. Background

A. The provisions of 40 CFR 86.082-26(a)(2) establish a procedure for mileage accumulation and state that manufacturers may use a modified procedure. Under these provisions EPA has permitted manufacturers to employ outdoor chassis dynamometers to accumulate mileage. Employing chassis dynamometers for mileage accumulation is only appropriate after determining the mileage accumulated on the chassis dynamometer is sufficiently similar to the mileage accumulated on a road route. In the past, this determination was made in advance by EPA. However, in an October 26, 1981 letter to manufacturers, EPA transferred to the manufacturer the authority to judge the appropriateness of using an outdoor chassis dynamometer.

B. In a July 1, 1981 letter to manufacturers, EPA issued several revisions to the existing criteria (A/C No. 35A) to be used to determine whether the mileage accumulated on a chassis dynamometer is representative of mileage accumulated on a road route. This A/C incorporates these revisions as well as one additional revision conditionally eliminating the speed/time trace required for those vehicles operated on the chassis dynamometer.

III. Applicability

A. The provisions of this A/C are effective immediately and are applicable to gasoline-fueled and diesel light-duty vehicles and trucks. The provisions apply to the use of an outdoor chassis dynamometer on which durability-data and emission-data vehicles accumulate mileage.



B. The use of indoor chassis dynamometers for mileage accumulation is not approved.

IV. Discussion

A. As discussed in II.A above, a manufacturer will no longer be required to obtain EPA approval to use an outdoor chassis dynamometer for mileage accumulation. Instead, the criteria set forth in this A/C will be the basis upon which each manufacturer will make engineering judgments as to the ability of their chassis dynamometer, and related systems, to accurately simulate the temperature and load conditions of a driver-controlled vehicle operated on a road route meeting the requirements of 40 CFR Part 86, Appendix IV.

B. There are many vehicle characteristics which can influence whether representative temperatures and engine loads are maintained during operation on the chassis dynamometer. The manufacturer is responsible for assuring that the mileage accumulated by vehicles driven on the chassis dynamometer and the mileage accumulation over the road route are representative of each other. This A/C contains only the basic parameters upon which each manufacturer will base its engineering judgments as to the similarity between the mileage accumulation on their chassis dynamometer and a road route.

V. Minimum Demonstration Vehicles Needed to Support Similarity Between Chassis Dynamometer Operation and Road Route Operation

A. The manufacturer will obtain data (see paragraph VI) from at least one vehicle for each vehicle classification (e.g., gasoline-fueled light-duty vehicles, gasoline-fueled light-duty trucks).

B. At a minimum the manufacturer is to consider the following basic vehicle characteristics in selecting their demonstration vehicles.

1. Catalyst or thermal reactor usage,
2. Catalyst or thermal reactor location,
3. Engine location (i.e., front, mid, or rear),
4. Vehicle shape and ground clearance,
5. Inertia weight class.

C. A manufacturer whose product line within a classification is very diverse is to obtain data on as many vehicles as they determine appropriate in their engineering judgment. (In the past EPA selected a maximum of three vehicles per classification.)

VI. Minimum Data Requirements Needed to Support Similarity Between Chassis Dynamometer Operation and Road Route Operation

A. In order to qualify a chassis dynamometer system, it will be necessary to show similarity in the data recorded from the demonstration vehicle(s) when driven on an existing approved test track route for at least three laps (laps 2, 10, and 11) of the Durability Driving Schedule, 40 CFR Part 86, Appendix IV, and the same vehicle when operated on a chassis dynamometer representative of the system(s) to be used. (The similarity in vehicle data may be determined on the basis of data recorded on one day or for a longer period.)

B. Data from the variables listed below shall be obtained continuously, or of intervals close enough to evaluate transient conditions, on a vehicle driven both on an acceptable road route and a chassis dynamometer.

Variable

- | | |
|---|--|
| 1. Temperature | Location of Thermocouple: |
| a. ambient air | at inlet to engine compartment |
| b. engine inlet air | at clean side of air filter |
| c. oil (engine) | in sump, drain plug, or dipstick |
| d. coolant (engine) | both inlet and outlet of engine |
| e. chassis (underside,
two locations) | at or near the longitudinal
centerline of vehicle in the
center and back |
| f. catalyst container
(if applicable) | skin at inlet and outlet |
| 2. Manifold vacuum, wheel (or dynamometer) torque, or other
indications of engine load | |
| 3. Vehicle speed or wheel speed | |
| 4. Engine speed | |

C. Data plots or recordings of the above variables shall be maintained as long as the data generated by these vehicles are used to satisfy 40 CFR Parts 86 and 600 data requirements and be made available to EPA upon request.

VII. Minimum Acceptance Criteria

A. It is generally recognized that two drivers operating the same vehicle over the same test route and using the same prescribed driving schedule will show slight variations in driving patterns as reflected in manifold vacuum, acceleration rates, and temperature transients. It is, therefore, not necessary that the values of these parameters obtained on the dynamometer exactly duplicate the values of these parameters obtained on the road. In addition, exact mechanical precision on the part of the road simulator is not considered an accurate simulation of the driver controlled vehicle since few, if any, drivers are capable of accelerating, decelerating, or driving a steady speed over a variable road terrain without random variations in the load-speed pattern. Therefore, it is expected that the load-speed traces obtained on the chassis dynamometer will show normal variations similar to, but not necessarily an exact replica of, those shown on the actual road-driven route.

B. The difference in temperature between road and dynamometer operation which are allowed will depend on the system being tested and the location of temperature-sensitive components. For example, in the case of a system with a catalyst located under the body, greater attention will be given to close duplication of underbody temperatures than would be the case with a system having no temperature critical parts in an underbody position. Generally, temperature versus time curves should agree within 10°F for temperatures up to 100°F and within 10 percent for temperatures above 100°F.

C. The relation between engine speed and vehicle (or wheel) speed both on the road and on the dynamometer must be established in order to ascertain that transmission shift points on the dynamometer essentially duplicate the pattern observed on the road.

D. There is no specification in 40 CFR Part 86 relative to grade or condition of the road terrain, and wide variety of grade and terrain conditions exists in the durability routes described by the manufacturers in their applications for certification. A road simulator matching any approved durability route is satisfactory.

VIII. Authorization to Use Chassis Dynamometers

A. Each manufacturer will be responsible for determining whether the mileage accumulated on their chassis dynamometers is representative of road

route operation. Paragraphs V, VI, and VII set forth the minimum criteria upon which such a determination is to be made.

B. Each manufacturer that has determined there is adequate similarity between dynamometer operation and road route operation will notify EPA of this determination in their application for certification. The manufacturer should maintain the data and information used to make such determination for as long as the information is applicable to a vehicle which was used to generate data to satisfy 40 CFR Parts 86 and 600. In addition, these data and information must be made available to EPA upon request so that EPA can determine if data generated in support of certification was valid.

C. Manufacturers are reminded that, when using an approved chassis dynamometer for mileage accumulation, the road route/dynamometer schedule being used must be the designated in their application.

IX. Vehicle Operation on the Dynamometer

A. For dynamometer systems which control manifold vacuum it is important to make periodic checks to determine if the manifold vacuum, as controlled on the chassis dynamometer, continues to correspond to the actual vacuum requirements on the road. At a minimum, these checks should be made before continuing mileage accumulation on the dynamometer at a point between the test at 20,000 miles and 30,000 miles. Discrepancies revealed by these checks must be corrected before continuing mileage accumulation.

B. It is important that malfunctions to vehicles accumulating mileage on a chassis dynamometer be recognized with no more time lag than would occur if the vehicle were accumulating mileage on the road.

1. Since the road simulator causes the driver to be eliminated from the feedback network, the manufacturer may utilize some type of monitoring system to detect any potential vehicle or dynamometer malfunction. This approach is particularly desirable for a road simulator installation in which auxiliary power (electric motor or equivalent) is used to simulate inertia or downhill operation. With this type of installation, auxiliary power may compensate in case of vehicle malfunction or general vehicle deterioration by "driving" the crippled vehicle. If the manufacturer does not utilize such a detection system, on-the-road evaluations must be made every 2,500 miles (+500 miles) for durability-data vehicles and at or near the midpoint of mileage accumulation for emission-data vehicles. Emission test monitoring will not be acceptable.

2. The provisions of §86.082-25(a)(5) require an overt indication of malfunction in order to justify unscheduled maintenance. A vehicle malfunction, detected during dynamometer operation, can be verified either on

the dynamometer or by an on-the-road evaluation to determine the need for unscheduled maintenance. If the verification is to be performed on-the-road the test vehicle must be driven on an approved mileage accumulation road route determined to be acceptable for the engine family from which the vehicle being tested is a member.

C. It is the manufacturer's option to alternate between a chassis dynamometer system which they have determined meets the minimum criteria of this A/C and a mileage accumulation road route which they have established for that engine family. This fact is to be recorded on the vehicle's mileage accumulation record and is to be made available to EPA upon request.

X. Data to be Recorded

A. For all vehicles accumulating mileage on a chassis dynamometer, the following data must be recorded by the manufacturer and maintained as long as the data generated are used to satisfy 40 CFR Parts 86 and 600 data requirements.

1. A continuous record of vehicle speed versus time. This record will serve the same purpose as a tachometer graph from a test vehicle operated on the road and must reflect the mileage accumulation route submitted in the application for certification. If the manufacturer can assure that the system design provides adequate safeguards that the dynamometer will follow the correct driving schedule throughout all mileage accumulation, this record is not required.

2. On chassis dynamometers which do not control manifold vacuum or wheel (or dynamometer) torque, a check of the engine load indicating parameter(s) is to be made at least every two hours. This record is to verify that this simulation of the original road-load requirements has been maintained. Any maintenance or load setting adjustments made to maintain this relationship must be indicated on vehicle data sheets kept by the manufacturer.

B. These data shall be made available to EPA upon request. If the data do not meet the requirements of this section, EPA will consider whether modifications in the procedure need to be made, whether the vehicle should no longer accumulate mileage on the chassis dynamometer, or depending upon the extent of the variation, if the vehicle will be disqualified.